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Prickly Pear Creek Water Diversion Proposal

Draft Environmental
Impact Statement

May, 1974

Prepared by:
Montana Department of Natural
Resources & Conservation
Water Resources Division

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May 31, 1974

Following is the Draft Environmental Impact Statement for a proposed water diversion project near East Helena, Montana. As a means to commence the project and pursuant to the Montana Water Use Act, Diehl Development Corporation of Helena, Montana, has applied to the Department of Natural Resources and Conservation for a Beneficial Water Use Permit. In the application for a permit, the Corporation requested a water appropriation of 20 cubic feet per second (c.f.s.) from Prickly Pear Creek between September 16 and April 14 of each year. The proposed point of diversion is approximately $4\frac{1}{2}$ miles upstream from East Helena.

I encourage you to carefully review this statement and invite your response. Any written comments should be submitted to me by June 30, 1974. In the event a final impact statement is prepared, written comments will be included.

In arriving at a decision upon this permit request, the Department will consider both written response to this statement and written and oral comments given at a public hearing. The hearing will be held June 10, 1974, in the Department of Natural Resources and Conservation Auditorium at 32 South Ewing in Helena, Montana. The hearing will begin at 7:00 p.m.

This Draft Environmental Impact Statement was prepared in compliance with the Montana Environmental Policy Act, Section 69-6504 (b) (3), and was submitted to the Environmental Quality Council on May 31, 1974.

Sincerely,

A handwritten signature in dark ink, appearing to read "Gerhard M. Knudsen".

GERHARD M. KNUDSEN
ENVIRONMENTAL COORDINATOR

DRAFT ENVIRONMENTAL IMPACT STATEMENT

PRICKLY PEAR CREEK
WATER DIVERSION PROPOSAL

Prepared by
MONTANA DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION
WATER RESOURCES DIVISION
32 SOUTH EWING
HELENA, MONTANA 59601

Submitted pursuant to:
Montana Environmental Policy Act
Section 69-6504 (b) (3)

May 1974

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I. INTRODUCTION

Among the provisions of the Montana Water Use Act of 1973 is the requirement that no new appropriation of surface water may be made unless a permit has first been applied for and granted by the Department of Natural Resources and Conservation, hereinafter referred to as the Department.

Actions of Diehl Development Corporation

At 9:20 a.m. on August 15, 1973, Diehl Development Corporation of Helena, Montana submitted an Application for Beneficial Water Use Permit to appropriate 20 cubic feet per second (c.f.s.) from September 16 to April 14 of each year from Prickly Pear Creek, a tributary of the Missouri River. The point of diversion would be in the Northwest Quarter of the Northeast Quarter (NW $\frac{1}{4}$ NE $\frac{1}{4}$) of Section 23, Township 9 North, Range 3 West, Jefferson County, Montana. (Figure A) The means of diversion would be by a pump and pipeline which would deliver the water to two proposed dams, one of 21,000 acre feet capacity and the other of 250 acre feet capacity. (Figure B) According to the application, the water would be stored for irrigation, stock water, commercial and municipal use.

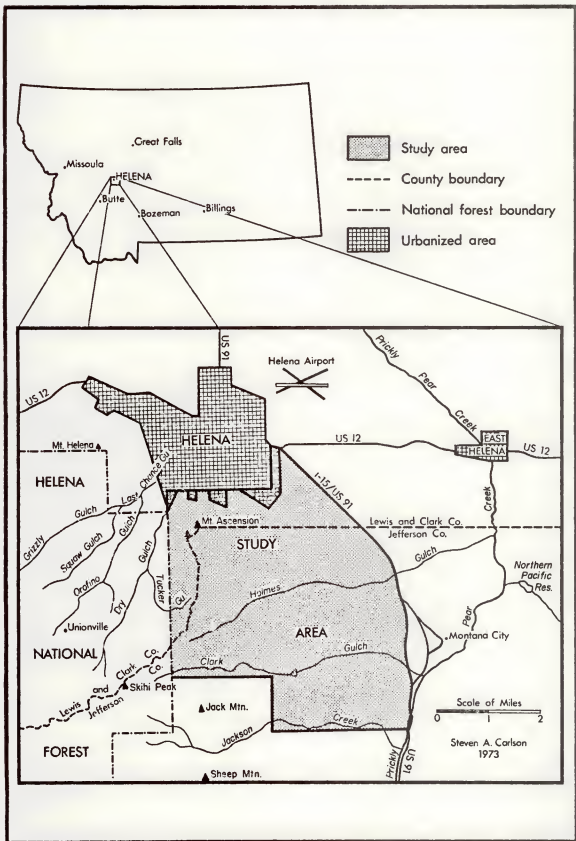
In addition to filing the application, Diehl Development Corporation has:

- (1) Prepared a land-use capability study of the development area,
- (2) Prepared a projected water demand study for the development, and
- (3) Engaged a consulting engineering firm to prepare preliminary project plans and estimates.

Montana Environmental Policy Act

The Montana Environmental Policy Act (Section 69-6501 through 69-6517, R. C. M. 1947) and guidelines adopted by the Montana Environmental

FIGURE A
LOCATOR MAP



SOURCE: Diehl Development Corporation, Land-Use Capability Study, S. E. Helena Project, 1973



Quality Council require State agencies to prepare environmental impact statements when proposed actions may significantly affect the environment, and a statement is specifically required if the action is controversial. Prior to acting on the permit request by Diehl Development Corporation, the Department determined that an environmental impact statement should be prepared because:

- (1) The proposed operation may result in significant environmental impacts, and
- (2) The proposed action is of a controversial nature.

This is the first application filed under the Water Use Act which necessitates preparation of such a statement.

Actions of the Department

Pursuant to Section 89-881 (1), R. C. M. 1947, a notice of application was published as a Notice to Water Users in The Helena Independent Record on January 14, 21, and 28, 1974, and in The Boulder Monitor on January 17, 24, and 31, 1974. The notice published in both newspapers stated that the Department would accept objections to the application until and including March 28, 1974; objections from thirteen separate objectors were received by that date.

Section 89-883, R. C. M. 1947, provides that a public hearing must be held, if the Department determines the objections to be valid, within sixty (60) days from the date set by the Department for the filing of objections, and that notice of the hearing be served by certified mail upon the applicant and objectors. The sixty-day period ended on May 27, 1974.

The hearing on this application was originally scheduled for Thursday, May 23, 1974, at 7:00 o'clock p.m., in the Auditorium, Second Floor

of the Department of Natural Resources and Conservation Building, 32 South Ewing, Helena, Montana 59601. Notices of the hearing were sent to the applicant and objectors on April 16, 1974, by certified mail with return receipt requested.

In order to allow the public sufficient time to review this Environmental Impact Statement, permission to postpone the hearing until June 10, 1974, was obtained from Diehl Development Corporation on May 21, 1974. Notice of the re-scheduled hearing was sent by certified mail to the applicant and objectors on the same date.

Section 89-884, R. C. M. 1947, provided that "The Department shall grant, deny, or condition an application for a permit in whole or in part within...one hundred eighty (180) day [after the last date of publication of notice] if a hearing is held." Therefore, action on the application must be taken by July 30, 1974.

II. DESCRIPTION OF THE PROPOSED ACTION

Kind of Use

According to Diehl Development Corporation's Application for Beneficial Water Use Permit (Application No. 107-s41-I), the applicant intends to appropriate 20 c.f.s. from Prickly Pear Creek from September 16 to April 14, over and above existing decreed water rights, for use as follows:

- (1) Irrigation purposes from April 1 to November 15, inclusive, of each year,
- (2) Municipal and commercial purposes from January 1 to December 31, inclusive, of each year, and
- (3) Stock-watering purposes from January 1 to December 31, inclusive, of each year.

The water would be directed exclusively to irrigation purposes initially, and later to commercial and municipal uses as the economy and population growth of Helena and the surrounding area justify a subdivision development within the 10,665 acre Diehl Development Corporation S. E. Helena Project. With regard to the subdivision, the water would be devoted to uses generally associated with planned unit developments, such as landscaped and irrigated parks, golf courses, boulevards, lawns, gardens, and recreation ponds and facilities. The irrigable lands outside the development area would continue to be irrigated to the extent of available water supply.

Place of Use

The proposed place of use would be in Sections 9 and 30, Township 10 North, Range 2 West, and Sections 1 through 11, 14 through 17, and 31 through 33, Township 9 North, Range 3 West, in Lewis and Clark and Jefferson Counties,

Montana, and containing 12,800 acres, more or less. ^{about} Approximately 3,000 acres within the above-described lands are initially proposed for irrigation, although their exact locations and times of conversion to other uses are unknown.

Facilities

The two reservoirs proposed for the above purposes are described as follows:

- (1) Clark Gulch Dam site located in the West Half ($W\frac{1}{2}$) of Section 16, Township 9 North, Range 3 West, with a proposed capacity of 21,000 acre feet, and
- (2) Holmes Gulch Dam site located in the Southwest Quarter of the Northwest Quarter ($SW\frac{1}{4} NW\frac{1}{4}$) of Section 10, Township 9 North, Range 3 West, with a proposed capacity of 250 acre feet.

The Clark Gulch Dam would be designed to provide adequate storage to supply seasonal irrigation use and carryover capacity for years of lower-than-average streamflows, taking into consideration evaporation and seepage losses. As the housing development materializes, the dam would supply the needs for commercial, municipal, and recreational use, and the balance of irrigation demands.

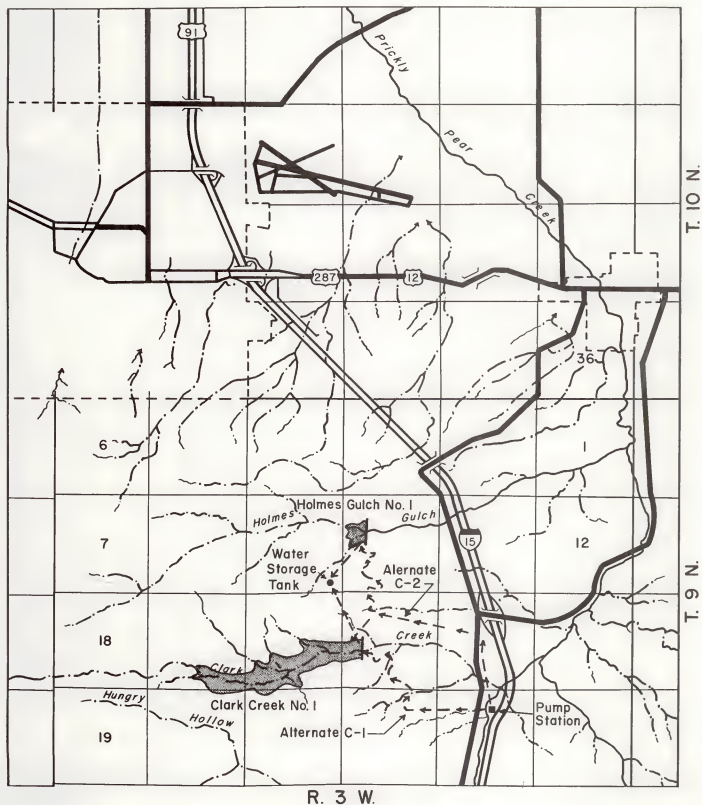
From the pump station which would be installed at Prickly Pear Creek (Figure B), water would be conveyed by means of a buried pipeline to the reservoir proposed for Clark Gulch. Water would be pumped from the Clark Gulch Reservoir and conveyed by buried pipeline to the Holmes Gulch Reservoir and those lands which can be irrigated. (Figure B) Irrigation would be accomplished by a sprinkler system. That portion of the irrigable land within the proposed development area would be served by buried lines, which would later serve the subdivision development.

Information Limitations

The application itself, supplemental material provided by the appli-

cant, and discussions with the applicant have provided the total extent of information available on what actions will be taken. The applicant is awaiting the water right decision before investing in detailed plans. Therefore, much of the analysis to be found in this Environmental Impact Statement is ~~of necessity~~ based on assumptions of the applicant's actions subsequent to the Department's decision.

FIGURE B
PROJECT MAP
Proposed Diversion and Storage



SOURCE: Montana Department of Natural Resources and Conservation, 1974



III. EXISTING ENVIRONMENT

Climate (17)

The climate of the proposed development site may be described as modified continental. Among the factors modifying the continental climate characteristics are invasions by Pacific Ocean air masses and drainage of cool air into the valley from the surrounding mountains. The protecting mountain shield makes temperature changes somewhat smaller than those typical of a true continental climate.

As may be expected in a northern latitude, cold waves may occur from November through February, with temperatures occasionally dropping to zero and below. The greatest number of days with zero or colder temperatures occur during January. There are about 161 days, on the average, between the last date in the spring with a minimum of 28° and the first such date in the fall. The average dates of these occurrences are April 27 and October 5. The same dates for 32° occurrences are May 12 and September 23.

Summertime temperatures are moderate with maximum readings generally under 90° and very seldom reaching 100°.

Twenty-four hour changes seldom exceed 40°.

TABLE 1 - AVERAGE TEMPERATURE

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Annual</u>
18.6	23.2	31.4	33.3	52.9	59.5	68.4	66.2	56.0	45.6	31.6	24.2	43.4

Source: Helena Weather Station through 1972, 93 Years of Record

Most of the precipitation falls from April through July in the form of frequent showers or thunderstorms, but usually with some steady rain in

June, the wettest month of the year. April-September growing season precipitation varies considerably, but the average is about 8 inches. Late summer, fall and winter months are relatively dry.

TABLE 2 - AVERAGE PRECIPITATION

<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug</u>	<u>Sept</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>	<u>Annual</u>
.47	.43	.70	.83	1.56	2.23	1.03	.89	.95	.66	.57	.53	10.85

Source: Helena Weather Station through 1972, 93 Years of Record

Air Quality

Denny describes air quality at the project area as being similar to that existing in the Helena-East Helena region, where nearly all state ambient air quality standards are occasionally exceeded (3). However, the project area should have a minimal air pollution problem, since it is west of the major pollution sources and upwind of the prevailing wind direction. Also, temperature inversion of sufficient duration to cause pollution problems are infrequent.

Hydrology

Ground Water - Many domestic wells have been drilled in the vicinity of the proposed development. Wells in granites and metasediments other than limestone, drilled to a depth of over 200 feet, yield only 2 to 3 gallons per minute (g.p.m.). Water in granites occurs in joints and fractures which generally tighten with depth.

However, if recharge is adequate, limestones can supply large quantities of ground water to wells through joints, fractures, solution cavities, etc. A well in limestone with a reported yield of 250 g.p.m. is located next to Prickly Pear Creek.

More information is needed to assess the possibility of putting in a well field tapping limestones within the proposed development area. A water table map should be prepared from measurements of as many wells as possible in the immediate area and along Prickly Pear Creek from the proposed point of diversion to East Helena. Additional observation wells would be desirable in those areas where wells have not been drilled. Seasonal ground-water fluctuations should be monitored in selected wells.

Increased flows observed in lower Prickly Pear Creek are attributable to ground-water recharge during the irrigation season. Drainage works in the valley plus a substantial increase in major ion concentrations support this contention. The average flow of 1 c.f.s. from the sewage treatment plant is insufficient in itself.

Surface Water - Prickly Pear Creek has a drainage area of 192 square miles, with approximately 700 acres of irrigation above a U.S.G.S. gaging station operated for many years near the point of intended diversion and discontinued at the conclusion of the 1969 water year. (Figure F) The average discharge for 43 years of record is 48.3 c.f.s. or 34,990 acre feet per year. McClellan Creek is the only tributary between the Clancy and Mountain View School stations, but most of its flow is diverted for municipal water supply to East Helena.

Figure C shows the lowest mean monthly flows, the highest mean monthly flows and the average monthly flows for the years of record between 1909 and 1969. The lowest mean monthly flow on record during the proposed pumping time (September 16 to April 14) is 9.32 c.f.s. during September, whereas the highest mean monthly flow on record during the same period is 131 c.f.s. during April. The average monthly flows during the proposed pumping time range from 21.1 c.f.s. to 52.6 c.f.s. (Table 3 and Figure C).

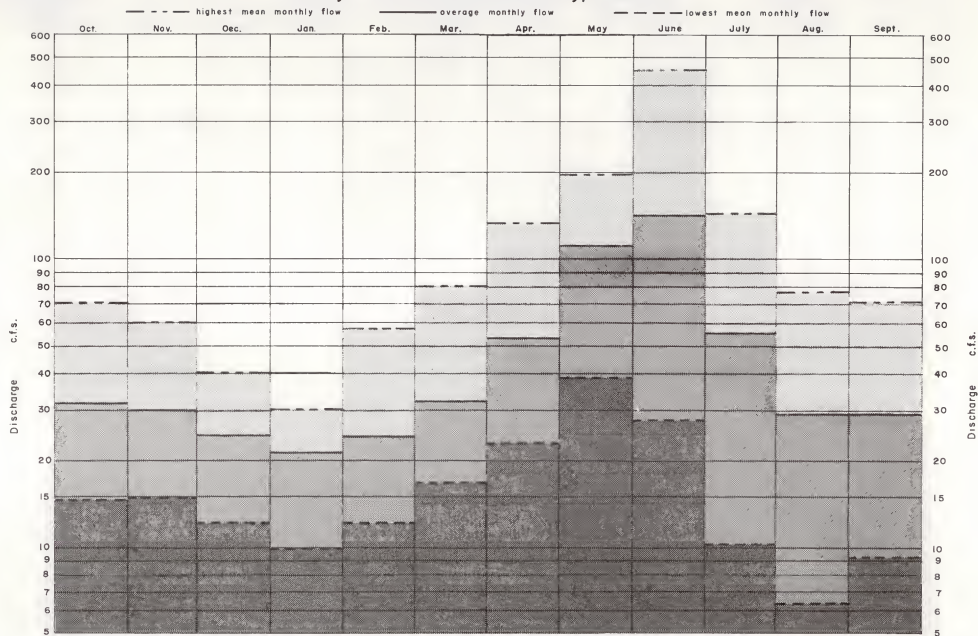
TABLE 3 - MONTHLY STREAM FLOW

Prickly Pear Creek Near Clancy, Montana

MONTH	LOWEST MEAN MONTHLY FLOW c.f.s.	HIGHEST MEAN MONTHLY FLOW c.f.s.	AVERAGE MONTHLY FLOW c.f.s.
Oct.	14.5	70.	31.6
Nov.	14.8	60.	29.9
Dec.	12.0	40.	24.1
Jan.	9.94	30.	21.1
Feb.	12.0	57.3	24.0
Mar.	16.6	80.	31.9
Apr.	22.9	131.	52.6
May	38.4	194.	110.
June	27.4	450.	140.
July	10.2	141	55.1
Aug.	6.33	75.7	29.0
Sept.	9.32	71.4	29.0

Source: U.S.G.S. Water Supply Papers and Water Resources Data for Montana
For Years of Record Between 1909 and 1969

FIGURE C
HYDROGRAPH
Prickly Pear Creek near Clancy, Montana



SOURCE: U. S. G. S. Water Supply Papers (years of record, 1909 through 1969).



Figure D is a graphic representation of the low flow probability curves for 1, 7, 30 and 183 day low flows, as listed in Table 4. For example, the probability of 10 c.f.s. or less flowing at any time during any 7 day period is 17.5%, with a recurrence interval of 5.7 years, as shown in Figure D.

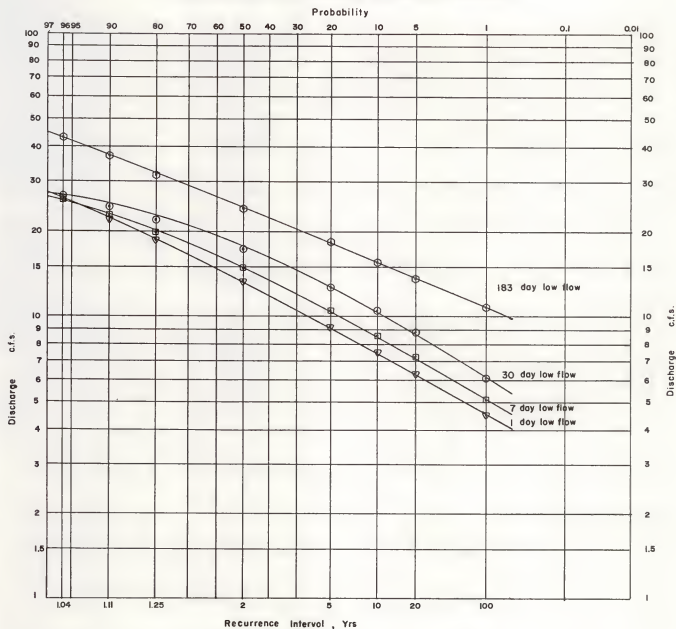
TABLE 4 - LOW FLOW PROBABILITY

Prickly Pear Creek Near Clancy, Montana

Probability (%)	Recurrence Interval (years)	Discharge (c.f.s.)			
		1 day	7 day	30 day	183 day
1	100	4.48	5.09	6.07	10.9
5	20	6.33	7.28	8.82	13.8
10	10	7.54	8.67	10.5	15.7
20	5	9.26	10.6	12.8	18.2
50	2	13.4	14.9	17.4	24.1
80	1.25	18.8	19.9	22.0	31.9
90	1.11	22.1	22.8	24.3	36.8
96	1.04	26.2	25.9	26.5	42.9
98	1.02	29.1	28.0	27.8	47.3
99	1.01	31.9	29.8	28.8	51.6
99 $\frac{1}{2}$	1.01	34.6	31.5	29.7	55.9

Source: U.S.G.S. Log-Pierson Flow Frequency Computer Program, 1968

FIGURE D
LOW FLOW PROBABILITY
 Prickly Pear Creek near Clancy, Montana



SOURCE: U. S. G. S. Log-Pierson Flow Frequency Computer Program, 1968



Figure E, the graphic form of Table 5, shows the high flow probability curves for the same time periods as Figure D. For example, Figure E reveals that the probability of 35 c.f.s. or more flowing at any time during any 183 day period (approximately 6 months) is 94%, with a recurrence interval of 1.06 years.

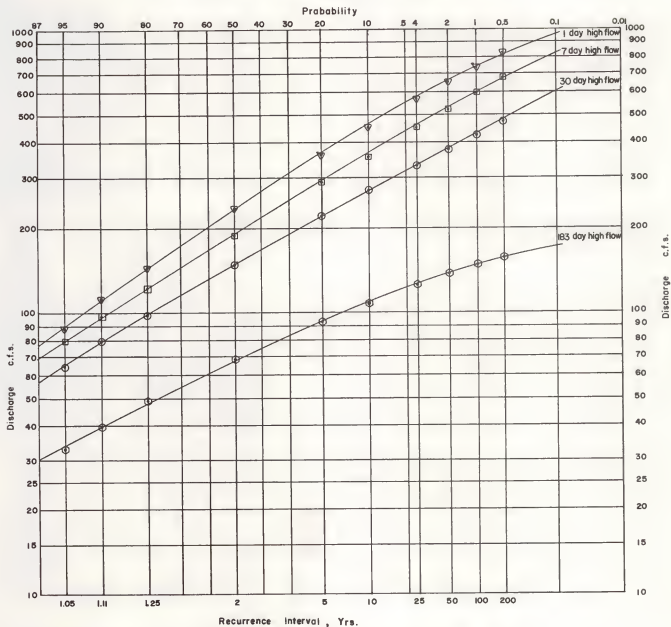
TABLE 5 - HIGH FLOW PROBABILITY

Prickly Pear Creek Near Clancy, Montana

Probability (%)	Recurrence Interval (years)	Discharge (c.f.s.)			
		1 day	7 day	30 day	183 day
99	1.01	58.0	55.6	44.5	23.4
95	1.05	89.4	79.8	64.3	33.2
90	1.11	112	96.6	77.9	39.5
80	1.25	145	121	97.7	48.2
50	2	233	187	148	68.3
20	5	363	286	220	92.8
10	10	452	355	269	107
4	25	567	447	331	124
2	50	653	518	376	135
1	100	738	591	422	145
0.5	200	825	666	468	154

Source: U.S.G.S. Log-Pierson Flow Frequency Computer Program, 1968

FIGURE E
HIGH FLOW PROBABILITY
Prickly Pear Creek near Clancy, Montana



SOURCE: U. S. G. S. Log-Pierson Flow Frequency Computer Program, 1968

Table 6 shows the results of weekly stream flow measurements made by the Department since February 1974 at 5 locations along the Prickly Pear Creek drainage. One of those locations is at the U.S.G.S. gaging station near the proposed diversion point. (Figure F)

The variances in stream flow may be caused by several factors. Among these are: irrigation withdrawals, ground-water inflows at Chemetron Corporation near East Helena, general ground-water inflows along the lower reaches of the creek, drainage water from agricultural lands, and discharges to the lower reaches from the Helena sewage system.

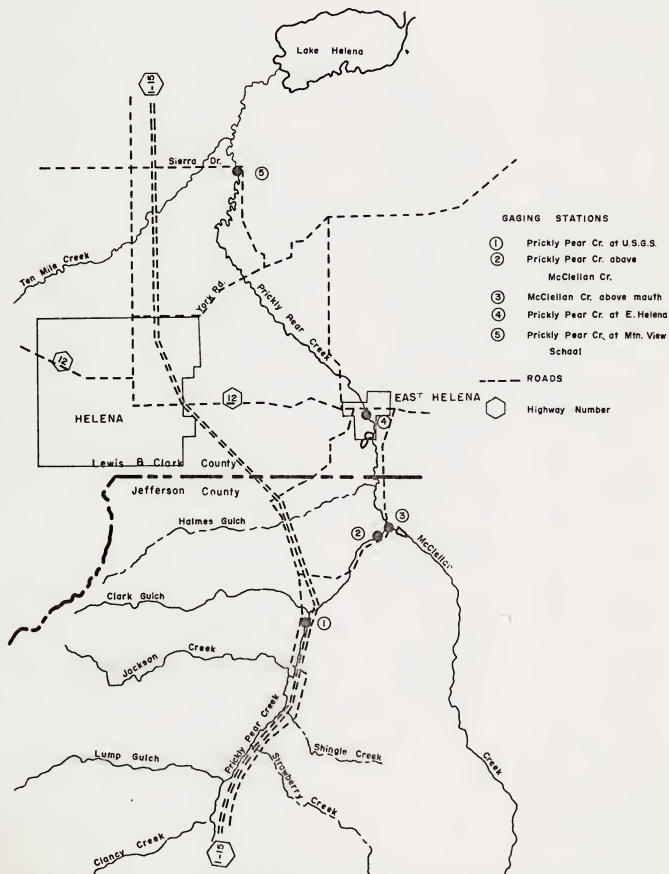
TABLE 6 - STREAM FLOW MEASUREMENTS, 1974

Discharge at Five Sites in c.f.s.					
Date	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Feb 8	17.7	15.8	2.79	20.4	24.8
Feb 15	16.4	16.3	2.65	20.4	22.9
Feb 22	15.2	16.9	3.06	17.7	19.1
Mar 1	16.9	18.6	2.50	18.1	21.0
Mar 8	14.7	15.0	2.39	15.4	24.4
Mar 15	14.2	15.6	2.00	14.7	24.4
Mar 22	22.4	18.3	2.63	15.0	17.7
Mar 29	31.4	32.3	6.69	33.5	38.2
Apr 5	22.1	23.0	2.13	16.8	23.5
Apr 12	36.8	35.9	5.09	32.2	26.0
Apr 19	43.2	44.8	11.7	46.4	12.8
Apr 26	87.5	86.4	17.5	76.0	15.2

1. Prickly Pear at U.S.G.S.
2. Prickly Pear Above McClellan Creek
3. McClellan Creek Above Mouth
4. Prickly Pear at East Helena
5. Prickly Pear at Mountain View School

Source: Montana Department of Natural Resources and Conservation, 1974.

FIGURE F GAGING STATION LOCATOR MAP



SOURCE: USGS and Montana Department of Natural Resources and Conservation, 1974

Water Use

Municipal and Industrial - Records available at this time show total municipal and industrial water rights ownership to be 571.5 miners inches (M. I.) or 14.3 c.f.s. Present rightholders are Kaiser Cement, American Smelting and Refining Company and the City of East Helena. Original appropriators, dates of priority and amounts appropriated are also shown on Table 7.

TABLE 7 - NON-AGRICULTURAL WATER RIGHTS

<u>Appropriator</u>	<u>Present Owner</u>	<u>Date of Priority</u>	<u>M. I.</u>	<u>c.f.s.</u>
Childs	Kaiser Cement	9/30/1862	14	0.35
Childs	A.S.& R. Co.*	9/30/1862	20	
Helena-Livingston Smelter	A.S.& R. Co.	3/1/1865	80	
Winston Brothers	A.S.& R. Co.	4/1/1865	17.5	
Moulton	A.S.& R. Co.	4/1/1865	65	
Helena-Livingston Smelter	A.S.& R. Co.	5/1/1866	80	
Helena-Livingston Smelter	A.S.& R. Co.	5/1/1866	50	
A.S.& R. Co.	A.S.& R. Co.	5/6/1866	100	
Thomas N. Shaw	A.S.& R. Co.	5/1/1868	100	
			512.5	12.8125
Chris Nelson	East Helena City of	4/1/1865	45	1.125
Total			571.5	14.3

*American Smelting and Refining Company

Source: Department of Natural Resources and Conservation, 1974.

A small amount of water (0.35 c.f.s.) is used on an interruptable basis by Kaiser Cement for cooling purposes. When utilized, this is a 100 percent consumptive use. American Smelting and Refining Company's 12.8125 c.f.s. is principally used for industrial coolants, and it is estimated that 90%, or 11.531 c.f.s., is returned to Prickly Pear Creek. The 1.125 c.f.s. municipal withdrawal by the City of East Helena is an approximate 100% consumptive use.

Municipal and industrial use is on a 365-day-a-year demand. Therefore, a minimum stream flow of 14.3 c.f.s. must be invariably maintained at the proposed point of diversion, in addition to the flow required for agricultural use during the irrigation season.

Agricultural - The largest use of waters from Prickly Pear Creek is agricultural. During the irrigation season minimum flow requirements to satisfy irrigation rights would be much greater than the 14.3 c.f.s. needed for municipal and industrial use. Below the City of East Helena, Prickly Pear Creek is totally dewatered on numerous occasions by agricultural diversions. Farther toward its mouth, return flows to the stream are again diverted for agricultural uses.

However, the total number of acres irrigated by Prickly Pear Creek water is undetermined. Several ranchers supplement their irrigation withdrawals with wells; others, with water purchased on contract with the Bureau of Reclamation. Although stock watering is considered a year-round use, the number of livestock watered from this stream varies from month to month and has never been exactly determined.

A water commissioner is on duty, beginning between April 1 and April 15 and ending between August 30 and September 30 of each year. Twenty-five agricultural appropriators are listed on his monthly reports.

Several ranchers, however, irrigate both before the court orders the water commissioner to start work for the season and also after his duties are terminated in the fall. The weather determines when the

ranchers start and stop irrigating for the year. It may be as early as March 1 and continue as late as November 1, depending on the rainfall and freezing conditions during this period.

In that no record of any kind is kept it is nearly impossible to determine the exact quantity of water being used for agricultural purposes each year before the water commissioner begins his duties in the spring and after he is discharged in the fall. A summary of the water commissioner's monthly reports during the irrigating season is available, but this summary does not include the period of diversion under consideration.

Other Uses - Fish, wildlife, and recreation are the only other important uses of the stream above East Helena. However, no water has been appropriated or reserved for this purpose.

Water Quality

Prickly Pear Creek is classified as B-D1 from its headwaters to the Montana Highway No. 433 bridge about one-half mile north of East Helena and as E-F below this bridge. The B-D1 classification means the stream can support a salmonid fishery, while the E-F classification means the stream is used only for agricultural and industrial purposes.

The quality of the B-D1 section is lowered by metal pollution from abandoned mines in its headwaters, channel alterations due to inactive placer mining, highway and railroad construction near the proposed diversion site, and industrial discharges downstream.

The E-F section of the stream suffers from extensive dewatering for irrigation. In addition, the discharge of poorly-treated municipal wastewater from the City of Helena is responsible for depressed dissolved oxygen, increased biological oxygen demand (BOD5), high coliform densities, and increased iron concentrations. This section of the stream does not sustain a normal stream biota.

The Alta Mine via Spring Creek is the major source of acid mine waters debasing to Prickly Pear Creek. However, several acid mine seeps of lesser magnitude affect Prickly Pear Creek just below its confluence with Spring Creek.

Trout populations in Prickly Pear Creek are drastically reduced after the entrance of Spring Creek. Maximum observed copper and zinc concentrations at the confluence with Spring Creek are 0.36 mg/l (milligrams per liter) and 20 mg/l, respectively. These concentrations exceed many times the incipient lethal levels for salmonids, which, in the instance of copper, is 48 ug/l (micrograms per liter). Incipient lethal level is the concentration at which indications of lethality are first apparent.

Prickly Pear Creek appears to have reached hydraulic stability since being placered. Substantial vegetative growth has re-established itself in most places, and sediment from past placer activity is not significant, as substantiated by the turbidities summarized in Table 8.

However, iron, zinc, copper, and lead concentrations could affect salmonid growth and propagation by affecting their food supply. As of June 21, 1973, 60.3 pounds of iron, 20.8 pounds of zinc, 2.08 pounds of copper and 4.16 pounds of lead were passing the gaging station daily. By October, iron, zinc, copper, and lead passing the station daily had decreased to 11.6 pounds, 3.64 pounds, 0.73 and 0.73 pounds, respectively. The difference is due to leaching in the Wickes-Corbin-Gregory area during spring runoff.

At Montana City, the stream receives its first industrial discharge from the Kaiser Cement Plant. At East Helena, Prickly Pear Creek receives non-contact cooling water discharge from National Gas Cylinder Company and American Smelting and Refining Company. After leaving East Helena, irrigation withdrawals reduce the stream to only a fraction of its former flow. Effluent from Helena's primary treatment plant enters Prickly Pear Creek about midway through the valley.

TABLE 8 - CHEMICAL AND PHYSICAL PARAMETERS

Prickly Pear Creek at U.S.G.S. Station Five Miles Below Clancy, Montana

<u>Parameter</u>	<u>6/21/73</u>	<u>8/1/73</u>	<u>10/11/73</u>	<u>1/10 of Acute Levels for Sensitive Aquatic Organisms in Soft Water</u>
Flow, c.f.s.	38.0	9.5	8.4	
pH	8.2	8.2	3	
Turbidity, JTU (*)	2	1	1	
Specific Conductance	183	278	283	
TR (**) iron, mg/l	0.29	0.18	0.16	0.02
TR zinc, mg/l	0.10	0.06	0.05	0.001
TR copper, mg/l	0.01	0.01	0.01	0.001
TR lead, mg/l	0.02	0.03	0.01	0.01
TR arsenic, mg/l	0.01	0.01	0.01	0.3
TR cadmium, mg/l	0.01	0.01	0.01	0.001

* Jackson turbidity units.

** Total recoverable. Samples are preserved with 5 ml (milliliters) of concentrated nitric acid.

Source: Abraham Horpested, Department of Health and Environmental Sciences, January 11, 1974.

Results of water sampling near Clancy (in the B-D1 section) and the Mountain View School (in the E-F section) are:

1. Prickly Pear Creek near Clancy is a moderately hard, calcium bicarbonate stream with lesser amounts of sodium and sulfate. The stream is a hard, calcium bicarbonate type water at Mountain View School sampling station. Substantial increases in all major ion concentrations were apparent at the school station.
2. Iron, zinc, copper, and lead concentrations measured near Clancy (Table 8) generally decrease with flow. Inactive mines are the source of these metals.
3. Total recoverable iron concentrations at Mountain View School station were twice that at the inactive U.S.G.S. station or about 0.40 mg/l as Fe+3. An identical concentration was measured in the Helena sewage plant effluent on November 28, 1972.
4. Coliform densities as high as 99×10^3 organisms per 100 ml (milliliters) were recorded near the Mountain View School. Maximum coliform density for samples collected near Clancy was 75 organisms per 100 ml.
5. Nitrate and orthophosphate levels were several times higher at the Mountain View School station. Measured nitrate levels near Clancy never exceeded 0.42 mg/l, whereas concentrations as high as 4.0 mg/l (as NO3) were recorded at the downstream stations. Orthophosphate concentrations for samples collected near the school varied from 0.54 mg/l to 3.7 mg/l (as PO4) and from 0.01 mg/l to 0.09 mg/l (as PO4) for samples collected near Clancy.
6. Dissolved oxygen levels as low as 3.5 mg/l were measure below the sewage treatment plant discharge, which is near the Mountain View School.
7. Five-day biological oxygen demand at the school station varied from 3.1 mg/l to greater than 6.5 mg/l. Biological oxygen demand near Clancy on June 21, 1973 was 0.0 mg/l.
8. Stream turbidities were greater near Mountain View School than at the station near Clancy. Maximums of 23 JTU and 2 JTU were measured at the valley station and near Clancy, respectively. Stream turbidities probably were most increased by the sewage discharge, but upstream irrigation may have some effect.

9. High stream temperatures above Montana City could be due to increased exposure through removal of stream bank vegetation during highway construction and home development. A maximum stream temperature of 23.4° C was recorded on August 1, 1973, at the inactive U.S.G.S. station. The preferred temperature range for rainbow trout, one of the salmonids found in Prickly Pear Creek, is 13° C.(6)

Geology

According to geologic information derived from U. S. Geological Survey Map I-381 and an accompanying report by Knopf (7), the area proposed for development lies astride the northern boundary of the Boulder batholith. Rocks in the area range in age from Precambrian to recent. Boulder batholith granites of late Cretaceous Age are found in the southwest portion of the area.

Precambrian, Paleozoic and Mesozoic sedimentary rocks occur in a northwest-southeast trending zone through the central portion of the area. Quaternary unconsolidated sediments include gravels found along the northeast margin of the area and alluvium along stream channels. The oldest rocks in the area are the water laid Precambrian metasediments of the Belt Series consisting of quartzite, argillite, dolomite and limestone deposited in a time of transgressive and regressive seas.

The opening of the Mesozoic Era was marked by a period of erosion, followed by continued marine oscillation. The Era is represented by metamorphosed shales, sandstones and limestones.

A period of volcanic activity preceded the emplacement of the Boulder batholith. This period is represented by lavas, plugs, and stocks of varying composition.

During the Cenozoic Era the first Rocky Mountains were eroded, followed by uplift of the second Rocky Mountains. The Era is represented by unconsolidated Quaternary gravels and alluvium.

Twenty-three faults are shown to cut sediments within the proposed development area. (7).

Soils

Soils Series - The soils of the irrigable lands are predominantly the Musselshell series, 137 BC mapping unit, comprise 988 acres. The limiting factors for high production of row crops are a very shallow "A" horizon and a very high lime content in the "B" and "C" horizons. Whenever very high lime occurs within the upper 6 inches of soil, the phosphorous is limited, additional fertilizer costs are necessary, and some plants are difficult to germinate. Yields may be limited in spots, but sprinkler irrigation should produce 4 tons of alfalfa per acre.

The Sappington soil series consists of 426 acres of irrigable Class 2 and Class 3 lands. If not limited by slopes and undulation, the land would include some Class 1 classification. Where convex ridge tops exist, the soil may be eroded, and small areas of Musselshell soils appear. These soils are expected to yield 5 tons of alfalfa per acre.

There are 234 acres of Hilger soils, 167 C mapping unit, which are moderately favorable for irrigation. The limiting factors are the small stones and gravel aggregate scattered on the surface and within the profile. The subsoil has from 15% to 25% stones (small cobbles) and from 10% to 15% gravel mixed with loam. The topography of these soils is similar to that of the Musselshell series. (See Table 9) Expected yields are 3.5 to 4 tons of alfalfa per acre.

There are 86 acres of limited class 3 land, interspersed with Class 6, which could be irrigated with caution. The soils are of the Crago-Musselshell complex. Approximately 20% to 50% of the complex is Crago soils, 20% to 50% Musselshell soils, and 15% to 30% Nip soils. There may be 0 to 15% Rin-Root and Hauser soils, with less than 15% consisting of other soils. Expected yield is 3.5 tons of alfalfa per acre. The

complexity of the soil pattern will require a more detailed investigation before irrigation, because the Nip series and some others are shallow to bedrock.

Road, pipeline and similar constructions within the entire area should require on-site investigations to determine routes of minimum surface erosion.

Proposed Irrigation Development - The areas for consideration of irrigated agriculture lie both (1) within the area of the proposed Diehl development, near the source, and (2) outside the Diehl development below the proposed Holmes Gulch Reservoir. The source of water in both cases would be the proposed reservoir in Clark Gulch. The water would first be pumped into a pipeline for delivery into Holmes Gulch Reservoir and then pumped into supply lines for sprinkler irrigation.

(1) The irrigable area within the development is near and adjacent to the Holmes Gulch Reservoir site. The topography of the irrigable land varies from nearly smooth to moderately undulating, but the undulations aren't severe enough to hinder sprinkler irrigation. Construction of a topographic map would be advisable before irrigation is developed. At present there are no plans showing elevations and proposed lifts for water delivery, and the entire area of irrigable land may not be developed because of high costs of pumping.

(2) The irrigable land is on the east side of Interstate Highway 15. The drainage of the proposed irrigable soils is very good, with very little seepage expected. Irrigation water for this area could either be delivered by a pipeline at a high enough elevation for low head gravity sprinklers, or by running water out of Holmes Gulch Reservoir and then pumping from the gulch onto the land. The problem of crossing Interstate 15 may hinder a pipeline elevation for low head gravity sprinklers. The delivery of water by Holmes Gulch would be through a culvert already under the highway.

Irrigation of this entire area should be accomplished by the use of sprinklers. When assuming a limited water supply, it is advisable to cut acreage rather than using less water on a large acreage, because sprinkler irrigation costs would necessitate high yields. High water efficiency and maximum yields are the only economical way to pay high

development costs.

For further soils information, see Table 9 and Figure G.

TABLE 9 - PROPOSED IRRIGATION DEVELOPMENT

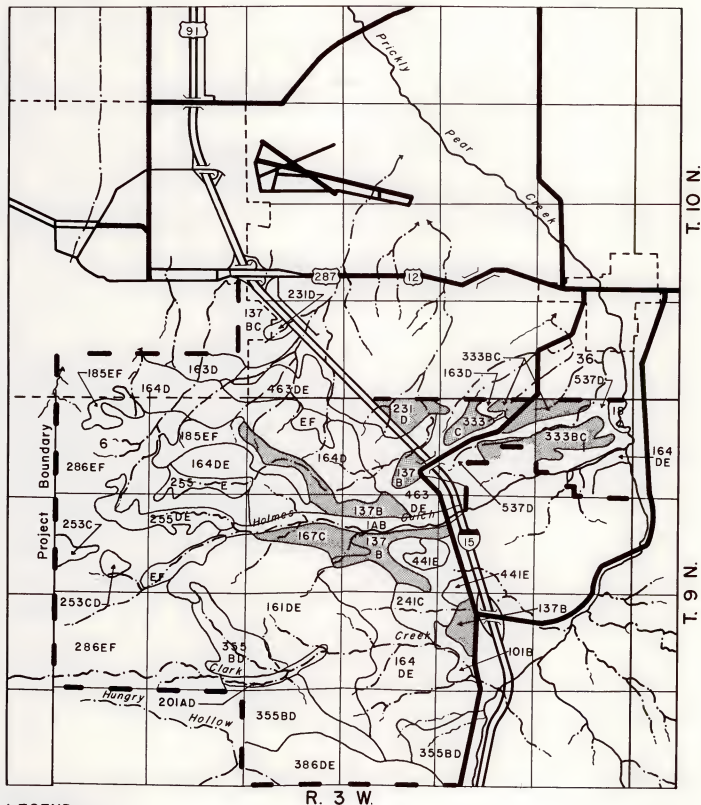
<u>SOIL MAPPING UNITS</u>	<u>SLOPE</u>	<u>SOIL CHARACTERISTICS</u>
137 B-Musselshell Series	2 to 5%	Dark grayish brown loam, 3" to 6"; pale brown to light gray loam or clayloam with very high lime, 6" to 29"; very gravelly fine sandy loam with very high lime, 29" to 60". Limiting factors: shallow to lime zone and poor moisture-holding capacity. Expected alfalfa yields: 3.5 to 4 tons per acre.
C-Musselshell Series	5 to 9%	
167 C-Hilger Series	5 to 15%	Stony loam, 0-5"; stony light clay 5"-9"; stony clayloam, 9" to 15"; stony loam, 15"-60". Limiting factor: stony soils. Expected alfalfa yields: 3.5 to 4 tons per acre.
231 D-Crago-Musselshell Complex	5 to 35%	Loam and gravelly loam soil. Limiting factors: steep slope, rockiness. Any area of over 15% slope not irrigable. Expected alfalfa yields: approximately $3\frac{1}{2}$ tons per acre.
333 B-Sappington Series	2 to 5%	Clay loam and loam soils to 60". Limiting factor: slope. Expected alfalfa yields: 5 tons per acre. Very favorable for irrigation.
C-Sappington Series	5 to 9%	

Source: Soil Conservation Service Surveys: Diehl Development Study Area-Lewis and Clark County Survey.

Proposed Suburban Development - The areas shown on Figure H may be developed for housing. The soils requirements for roads, septic tanks, and building sites will not be discussed in detail, but general comments are given in Table 10. If the sites are developed, the planning of

FIGURE G PROJECT MAP

Soils and Proposed Irrigation



LEGEND

 Irrigable Land—(Department of Natural Resources Land Classification Standards)

164D—Soil Mapping Unit (see Table 9 for descriptions and interpretations).

SOURCE: U. S. Soil Conservation Service, Soil Survey Data, Jefferson-Lewis and Clark Counties



the units will be adequate only if detailed on-site investigations are conducted.

For further soils information, see Table 10 and Figure H.

TABLE 10 - PROPOSED SUBURBAN DEVELOPMENT

<u>SOIL MAPPING UNITS</u>	<u>SLOPE</u>	<u>SOIL CHARACTERISTICS</u>
137 B	2 to 5%	Shallow to gravel, high lime. Satisfactory for housing construction.
137 C	5 to 15%	Some erosion. Satisfactory for housing construction.
161 DE	15 to over 35%	Satisfactory for housing development in most areas. Home sites not recommended on steep slopes.
163 D	15 to 35%	Deep skeletal soil with areas of shallow soil over bedrock. High percentage of limestone fragments in subsoil. Satisfactory for housing development.
164 DE	15 to 35% Some over 35%	Satisfactory for housing development. Home sites not recommended on steep slopes.
167 C	5 to 15%	Shallow to gravel, scattered surface rocks. Satisfactory for housing development.
231 D	15 to 35%	Complex of deep, very gravelly and deep loam subsoil. Spots of shallow to bedrock soil. On-site investigations needed to locate shallow bedrock areas.
241 CDE	5 to 35% Some over 35%	Steep slope. Shallow to bedrock. On-site investigations needed to locate steep and shallow bedrock areas.
253 CD	5 to 35%	Complex area. High percentage of soils are shallow to bedrock with spots of rock outcrops. On-site investigations needed to locate spots of deep soils suitable for housing development.

261 EF	Over 35%.	Very steep. Combination of soils with many rock outcrops.
355 BD	2 to 35%	Soils with both deeper pockets and shallow to bedrock areas. On-site investigations needed to locate deep soils areas suitable for housing development.
386 DE	15 to over 35%	Hilly topography. Ridges and some slopes are shallow to bedrock. Rock outcrops. On-site investigations needed. Housing development suitable in low areas and on slight slopes.
441		Shallow soils over limestone. Steep areas are scattered within mapping unit. Housing suitable in areas with deeper soils. On-site investigations needed.
463 DE	15 to over 35%	Shallow soils. Steep slopes. Housing development suitable in areas with deeper soils. On-site investigations needed.

Source: Soil Conservation Service Surveys: Diehl Development Study Area - Lewis and Clark County Survey

Vegetation

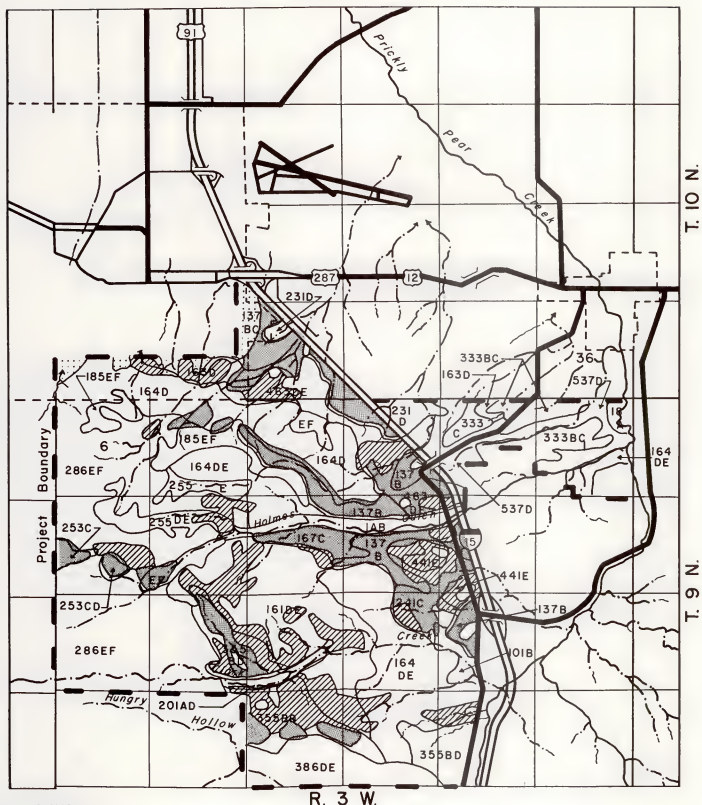
Vegetation of the area is generally comprised of those species which are capable of withstanding drought. Potential evapotranspiration exceeds precipitation, and plant communities are subjected to extended periods of moisture stress.

The area contains complex patterns of forests upon the north and east aspects. The forest types are dominated by ponderosa pine and Douglas-fir. Rocky Mountain juniper occurs throughout the area, although it is especially prevalent upon the drier ponderosa pine sites.

Grasslands, in which fescue-bluebunch wheat grass predominates, occur at the lower elevations and southand west aspects. Sagebrush communities

FIGURE H PROJECT MAP

Soils and Proposed Suburban Development



LEGEND

Urban Development—Helena

Home Sites—Intensive Development

Recreational Areas with Limited Home Sites

Recreational and Managed Lands—No Home Sites

164D—Soil Mapping Unit (see Table 10 for descriptions and interpretations).

SOURCE: U. S. Soil Conservation Service, Soil Survey Data, Jefferson—Lewis and Clark Counties



are found at lower elevations upon the drier aspects.

Black cottonwood, quaking aspen, and rose species have a limited distribution and are found along waterways where moisture is less limited.

Land Use

Historically, ranching and mining have been the principal land use activities carried on in the 10,665 acres comprising Diehl Development Corporation's S. E. Helena Project. (3)

With the decline of mining in the Helena vicinity, the S. E. Helena project area was and continues to be used primarily for the grazing of livestock and has supported a herd of between 200 and 500 cattle, depending on grass conditions. (3) The present range stocking capability is about 5 to 6 acres per AUM for an 8 month period each calendar year, although grass conditions vary with the amount of precipitation. An existing small reservoir at the upstream edge of the proposed reservoir in Clarks Gulch provides stockwater.

Low rainfall and a short growing season place a severe limitation on agricultural productivity even for those dryland crops, such as hay, grain and range forage, associated with this area. In the past some cultivation has occurred within the project area, but that land has now been reverted back to grazing use. Presently, the applicant also owns land outside the project area and east of Interstate 15 that is under cultivation.

Being fenced and posted the area receives little pressure other than for grazing. There are apparently no historical or archeological sites. Except for the property within the city limits, the project area is without land-use regulations.

Terrestrial and Aquatic Life

Although accurate population figures are not available, game and fur

- bearing animals observed on Prickly Pear Creek include deer, bear, coyote, fox, raccoon, beaver, and muskrat. A small herd of antelope is "trapped" but not thriving in the area. Porcupine and other small mammals have been sighted.

Ducks frequent the area, and other game birds, such as pheasants and Hungarian partridge, are probably present. In addition, many non-game birds are inhabitants of the area on a part-time or full-time basis.

Fish recorded in Prickly Pear Creek during the summer of 1973 include rainbow trout, brown trout, brook trout, longnose suckers, and white suckers. Heavy metal concentrations suppress salmonid populations in the headwaters, but good populations presently exist in the diversion area. Estimates made in 1973 show 530 yearling and older trout per mile of stream. This estimate was established from an approximately 3,300 foot section of Prickly Pear Creek in the area of the proposed water diversion point for the Diehl Development Corporation. (10)

During January 1974, a coulee flowing water through the Kaiser Cement Plant washed large amounts of material from its mine dump into Prickly Pear Creek, causing a significant fish kill downstream. A period of 3 years will probably be required before the fish population will be totally re-established in this stretch of stream.

Aesthetics, Natural Beauty and Tranquility

Gold dredging in past years has disturbed much of Prickly Pear Creek. Also, industrial development and the City of East Helena affect the aesthetics, natural beauty and tranquility of the stream.

Even with the past disturbances and current developments, Prickly Pear Creek is a brushy, natural-looking trout stream in much of its reaches and offers aesthetics, natural beauty and tranquility to those who wish to enjoy it.

Recreational Opportunity and Quality

The general Prickly Pear area provides a wide variety of recreational opportunities of relatively good quality. The most important single form of recreation is probably fishing, with an estimated 1,950 angler days spent along Prickly Pear Creek in 1973. (10) Hunting is limited. Other recreational opportunities include bicycling, motor biking, sight-seeing, picnicking, hiking, snowmobiling, and target shooting.

The area to be affected by the proposed action presently provides somewhat fewer opportunities. Hikers, picnickers, cyclists and snowmobilers occasionally use the area, although these sorts of uses are largely restricted. The use is mainly related to the open-space and visual resources.

IV. ALTERNATIVES

Legal Constraints

Alternatives available to the Department are restricted under the Montana Water Use Act, which became effective on July 1, 1973. A permit must be issued if the following specific criteria are met:

- (1.) there are unappropriated waters in the source of supply;
- (2.) the rights of a prior appropriator will not be adversely affected;
- (3.) the proposed means of diversion or construction are adequate;
- (4.) the proposed use of water is a beneficial use;
- (5.) the proposed use will not interfere unreasonably with other planned uses or developments for which a permit has been issued or for which water has been reserved. (Section 89-885, R. C. M. 1947)

Section 89-886, R. C. M. 1947, further qualifies the Department's possible actions as follows:

... The department may issue a permit for less than the amount of water requested, but in no case may it issue a permit for more water than is requested or than can be beneficially used without waste for the purpose stated in the application...It may issue a permit subject to terms, conditions, restrictions, and limitations it considers necessary to protect the rights of other appropriators...A permit shall be issued subject to existing rights and any final determination of those rights made under this act. [Emphasis added.]

An existing right is a right to the use of water which would have been protected under the law as it existed before July 1, 1973. Without a diversion of water, neither recreation nor fish and wildlife has been specifically recognized by state or court decision as a beneficial use under the earlier law. Although both are explicitly recognized as beneficial uses under the present law, no water right can be obtained without a permit, certificate, or reservation, and no such action has been taken with regard to Prickly Pear Creek.

Consequently, it appears that the Department's immediate legal obligation is to grant a permit for that amount of water, over and above that required for existing rights, which can be put to beneficial use—even if the result is dewatering of the stream. The only legal alternative would be for a court to find that public recreation and/or fish and wildlife is, in fact, an existing right under the old water law, which must therefore be protected under the new water law.

Other Considerations

Although the provisions of the Water Use Act are compelling, the Department must not ignore broader considerations of state policy regarding environmental quality.

Article IX of the Montana Constitution of 1973 provides:

Section 1 (3) The legislature shall provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to present unreasonable depletion and degradation of natural resources.

Section 4 The legislature shall provide for the identification, acquisition, restoration, enhancement, preservation, and administration of scenic, historic, archeologic, scientific, cultural, and recreational areas, sites, records and objects, and for their use and enjoyment by the people.

Under the Montana Environmental Policy Act of 1971, state agencies are directed to:

- (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations...
- (4) preserve important historic, cultural, and natural aspects of our unique heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice...
- (6) enhance the quality of renewable resources...(Section 69-6503, R. C. M. 1947)

In addition, the stated purpose of the Montana Environmental Policy Act is "... to declare a state policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment..." (Section 69-6501, R. C. M. 1947)

Under the Water Quality Act of 1971 (Section 69-4801, R. C. M. 1947), it is declared "... the public policy of this state to (a) conserve water by protecting, maintaining, and improving the quality and potability of water for public water supplies, wildlife, fish and aquatic life, agriculture, industry, recreation, and other beneficial uses..." [Emphasis added]

In the Montana Water Use Act itself, Section 89-866 (3), R. C. M. 1947, declares that "It is the policy of this state and a purpose of this act... to provide for the wise utilization, development, and conservation of the waters of the state for the maximum benefit of its people with the least possible degradation of the natural aquatic ecosystems..." [Emphasis added]

Environmental quality is unquestionably a valid concern, but one without the binding force of the law.

Statement of Physical Alternatives

Alternatives available to Diehl Development Corporation include voluntary reduction of the appropriation request. Ground water might instead be utilized, assuming a suitable location for a well field can be found, but this second alternative could result in lowering the water levels in nearby waters and affecting the flow of Prickly Pear Creek. A final alternative would be the purchase of water from nearby city or federal supplies.

However, discussion in this environmental impact statement will be limited to the following water diversion alternatives apparently

available to the Department, although both legal constraints and state environmental policy should be kept in mind.

1. Granting a permit for the appropriation of water over and above that needed to satisfy existing rights, and up to 20 c.f.s. from September 16 to April 14,
2. Granting a permit for the appropriation of water over and above that needed to satisfy existing rights, and up to 10 c.f.s. from September 16 to April 14,
3. Granting a permit for the appropriation of water over and above that needed to satisfy existing rights, and up to 5 c.f.s. from September 16 to April 14, or
4. Denying the permit.

The first three alternatives are intended to be representative of the range of options open to the Department concerning a diversion, for a permit, if granted or conditioned, may be for any amount of water up to 20 c.f.s.

V. ENVIRONMENTAL IMPACTS OF ALTERNATIVE ACTIONS

Climate

The storage of water in reservoirs results in increased vegetative growth around reservoirs and in irrigated fields increases transpiration.

TABLE 11 - ESTIMATED RESERVOIR EVAPORATION RATES

Reservoir Storage (A.F.)	Reservoir Size (Acres)	Annual Evaporation (A.F.)
987	38.8	100
2,203	82.9	214
4,391	135.9	351
7,692	194.2	501
12,149	251.6	649
17,721	305.5	788
25,353	355.6	917

Source: Evan Denney, Diehl Development Corporation Projected Water Demand, S. E. Helena Project, 1974, p. 4.

The amount of water evaporation, of course, depends primarily on the size of the reservoir, but it is doubtful that the maximum amounts which could be evaporated or transpired within the project area are sufficient to cause a detectable change in the microclimate.

Air Quality

Air quality in the project area is not expected to be significantly affected by the proposed action.

The potential for dust problems may increase in the future. Areas

tilled for irrigated cropping may be left devoid of vegetation during periods of the year and in an unstable condition. If so, blowing sand and dust are possible during those periods. As construction activity takes place in the project area, the vegetation also would be disturbed, permitting wind to transport fine sediments. Automobile traffic within the project area may create street dust, but this condition would be minimized if residential streets are paved.

Increased automobile traffic would also cause an increase in air pollutants resulting from exhaust discharges. When an extended air inversion exists in the locality, exhaust fumes could add to the short-term air quality problem.

Residential buildup would include the operation of home heating furnaces and fireplaces, which, to a small degree, contribute to air quality problems. The effects from these sources, except possibly during inversion periods, should be minor.

Hydrology

Ground Water - The effect on ground water of withdrawing an additional 5, 10, or 20 c.f.s. from Prickly Pear Creek cannot be determined from presently available data, because the extent to which Prickly Pear Creek gains or loses water from, or to the ground-water system is not known. However, ground-water recharge during the irrigation season contributes to increased flows in the lower reaches of the stream.

Since sufficient water must flow past the proposed diversion to satisfy the rights of downstream users, there may be little effect on ground-water levels—unless Prickly Pear Creek is the major source of ground-water recharge. Seepage from the proposed reservoirs would provide additional ground-water recharge, but the amount of seepage would be dependent on the joints, fractures, bedding, and other properties of

the underlying rock as well as the permeability of the material lining the reservoir.

Under the final alternative, denying the diversion permit, other sources of water such as wells or perhaps pipelines from more distant sources might be developed. Without knowing what those developments might be, their effects on ground-water cannot be analyzed.

Surface Water - Regardless of the alternative chosen, 14.3 c.f.s. must flow past the point of proposed diversion to the vicinity of East Helena every day of the year in order to satisfy prior non-agricultural water rights. In addition, some irrigation rights exist during the months of September, October, March, and April.

The following table summarizes the flow remaining at the proposed diversion point during the pumping period for an average year. (See also Table 3 and Figure C)

TABLE 12 - FLOW AVAILABLE AT POINT OF DIVERSION

<u>Month</u>	<u>Flow Remaining After Satisfaction of Non-Agricultural Rights</u>	<u>Estimated Agricultural Demands *</u>	<u>Remaining Flow</u>
Sept.	14.7 c.f.s.	Agricultural demand	9.7. c.f.s.
Oct.	17.3 c.f.s.	by late irrigators of about 5 c.f.s.	12.3 c.f.s.
Nov.	15.6 c.f.s.	No irrigation demand	15.6 c.f.s.
Dec.	9.8 c.f.s.		9.8 c.f.s.
Jan.	6.8 c.f.s.		6.8 c.f.s.
Feb.	9.7 c.f.s.		9.7 c.f.s.
Mar.	17.6 c.f.s.	Agricultural demand	12.6 c.f.s.
April	38.3 c.f.s.	by early irrigators of about 5 c.f.s.	33.3 c.f.s.

* Does not reflect stockwater demand for which rights may exist.

Source: Montana Department of Natural Resources and Conservation, 1974.

Under Alternative 1, April would be the only month during an average flow year that the full amount of 20 c.f.s. could be pumped. If the 20 c.f.s. were pumped at any other time, prior rights would be adversely affected. In addition, the stream would be totally dewatered below the last appropriator in the vicinity of East Helena during all months of the proposed pumping period except April.

Under Alternative 2, 10 c.f.s. could be diverted and prior rights simultaneously satisfied during four months (October, November, March and April) of the proposed pumping period during an average flow year. Prickly Pear Creek would be dewatered below the last downstream appropriator during the months of September, December, January and February.

Under Alternative 3, 5 c.f.s. could be pumped throughout the proposed diversion period without affecting prior rights during an average flow year. The lower reaches of the stream would never be completely dewatered, although the flow below the last downstream appropriator would be reduced to 1.8 c.f.s. in January.

Under Alternative 4, denial of the permit, the hydrology of Prickly Pear Creek would not be directly affected. Hydrologic impacts would result from possible subsequent development of other sources.

Water Use

Since any diversion permitted must be of flow over and above that needed to satisfy existing rights, the level of current municipal, industrial and agricultural uses could not in any case be decreased.

Under Alternatives 1 through 3, additional water would be directed to new irrigation, stock water and "commercial/municipal" uses, with initial emphasis on agricultural use and progressive conversion to domestic use. Because any of these three alternatives would remove

water from Prickly Pear Creek, present recreational and fish and wildlife uses would apparently be reduced. In addition, granting a permit would preclude all future water use options for the amount so appropriated, unless the permit is later revoked or the certificate of water right lost under abandonment provisions of the Montana Water Use Act. (Sections 89-887, 89-894 and 89-895, R. C. M. 1947.)

The effect on water use of denying the permit would be dependent on possible subsequent development of other sources.

Water Quality

Any reduction of stream flow (Alternatives 1 through 3) will intensify the thermal impact of the water discharge at East Helena and may increase the temperatures below the proposed withdrawal site. With the continued disposal of sewage from the Helena primary treatment plant, a reduced stream flow will also increase biological oxygen demand, nutrient levels, iron concentrations and depressed dissolved oxygen levels, further degrading the E-F section of the stream. The proposed withdrawal would probably not affect the heavy metal concentrations below the point of diversion.

Subsequent cultivation and construction practices could impact water quality through erosion, inefficient septic tanks and drain fields, etc.

Refusing to grant a permit would not directly affect the status of water quality, although impacts could result from possible subsequent development of other sources.

Geology

The proposed dam site on Clark Gulch is a quartzite outcrop which appears to be well-suited for such construction, although a study of possible porosity along joints or fractures should be made. Two faults

in the Northeast Quarter ($NE\frac{1}{4}$) of Section 15 could extend as far southwest as the proposed Clark Gulch dam site and should be investigated prior to construction. (7)

A study of the proposed location of the Holmes Gulch dam shows that the north end of the dam would be built on upper Cambrian argillites and dolomites, and the southern end on a tertiary rhyolite plug. Fracture or joint porosity could exist in the argillite, dolomite, or rhyolite. A brief examination of a rhyolite cut indicated possible interconnection between vesicles along joints. Before construction of the dam, a detailed site study should be made to assess the possibility of leakage due to the above-mentioned porosity (if any) or porosity along the contact between the sedimentary rocks and rhyolite.

Detailed mapping might show that the half-mile long, northeast-southwest trending fault trace in the North Half ($N\frac{1}{2}$) of Section 16 and the Southeast Quarter ($SE\frac{1}{4}$) of Section 9 extends as far northeast as the proposed Holmes Gulch dam site.

The fault pattern of the entire area should be further investigated and carefully considered in selecting building sites. Knopf shows several faults which cut Quaternary deposits. (7) If these faults do, in fact, cut these deposits, it would indicate geologically recent movement and the possibility of continued activity.

Soils

Under Alternatives 1 through 3, areas of varying size would be inundated and thereby removed from productivity.

Granting a permit for 20 c.f.s. would provide water for full irrigation of all irrigable acres (Figure G) and, under proper management, could result in improvement of soil structure and fertility. Under permits for 10 or 5 c.f.s., fewer acres could receive a full water supply, with a possible result of less overall improvement of soil structure

and fertility. However, under poor irrigation management, water could be wasted, soils could be eroded, and fertility could be reduced through leaching of nutrients.

As irrigated lands are converted to suburban development, similar effects could be produced. Good management could result in improvement; poor management, in deterioration. Any construction or overgrazing on shallow soils or steep slopes would have a particularly severe impact.

Denying the permit would eliminate irrigation and the effects derived therefrom. Similar or identical suburban impacts could still result, depending upon possible development of other water sources, the type of sewage treatment utilized, and other factors.

Vegetation

The nature and degree of impacts upon vegetation under Alternatives 1 through 3 will vary with time and space.

In the short-run, any impact will be confined to those areas affected by the diversion effort. Construction of the dams and the diversion and irrigation systems will involve displacement of vegetation. With regard to the dams and diversion facility, there will obviously be no opportunities for vegetational regrowth.

Those areas disrupted during pipeline construction will ultimately reseed naturally. However, the growth potential will in large measure depend upon reclamation efforts. Although not known, it is possible that the areas could be artificially reseeded with either native or exotic species.

The impact of the irrigation itself will largely involve the replacement of natural vegetational types upon irrigable lands with agricultural crops.

As the land development program proceeds, the irrigable lands will be converted to urban development with an attendant change in vegetational cover. The increase in human pressures attributable to urbanization will alter the natural vegetation over a larger area. The degree of vegetational impact will vary with the extent of development and the nature of land-use restrictions.

Land Use

The Application for Beneficial Water Use Permit indicates that eventual residential development will take place. In the interim, some 3,000 acres, both within and outside the project, are proposed for cultivation and irrigation. An analysis of soils surveys indicates that approximately 1,200 acres meet the Department's classification standards for irrigable lands. Although these are the potentially most productive acres, the applicant can irrigate less promising land if he so desires.

Currently, a national trend exists of suburbanization spreading from the fringe of cities. Development around Helena follows this pattern, with considerable growth taking place southeast of Helena where Interstate Highway 15 provides easy access to the city. Because Diehl Development Corporation's project is adjacent to the city, development will unquestionably occur once the tracts or lots are platted and placed for sale. A major impact will then be the phasing out of agricultural uses--livestock grazing and irrigated cultivation--as urban development proceeds.

According to the application, a population of 8,500 is to be served domestic water under this requested permit, but the basis or assumptions used to obtain this projection have not been furnished. Based on the projection provided, and assuming 3.1 persons per residence one can estimate that 2,742 residences would be needed within the area. (13)

Denney estimates the number of single and multiple family residential units within the project as 1,669 and 185, respectively, for a total

of 1,854 family units. (4) However, the assumptions used are his and not necessarily those of the developer. (5)

Based on these two estimates, between 1,854 and 2,742 families may reside in the area and require water. The rate of population influx, extent of development, and specific locations of development are unknown and depend upon the developer's objectives and plans, the population growth of Helena, and the general economic conditions that prevail.

Alternatives 1 Through 3 - Approximate figures concerning population and acres of irrigation which could be supported under the three diversion alternatives are given in Section VI. Population figures vary from a high of 15,834 under Alternative 1 to a low of 6,363 under Alternative 3. The acres of land that could adequately be irrigated under the diversion alternatives range from a high of 1,335 to a low of 537 for the same alternatives. (See Table 18) The total number of acres that can be adequately irrigated and the total number of people that can be supplied water are functions of water availability.

However, the land area devoted to residences, streets, parks and other uses varies with housing density and other, as yet undefined, development criteria. Using densities of 2 and 4 residences per acre, an approximation of the total amount of land that could be converted to residential use is as follows:

TABLE 13 - ACRES OF RESIDENTIAL DEVELOPMENT

Alternative	Supportable Population	Number of Residences*	Land Requirement In Acres	
			Assuming 2 residences per acre	Assuming 4 residences per acre
1	15,834	5,107	2,554	1,277
2	13,201	4,258	2,129	1,065
3	6,363	2,053	1,026	513

*Assuming 3.1 persons per residence

Source: Montana Department of Natural Resources and Conservation, 1974.

Residences would probably be located on those lands indicated on Figure H. Suburban development also requires additional land for such uses as streets, schools, and parks.

The acreage that would be flooded by the Clark Gulch reservoir would vary with the size of dam constructed. A large reservoir would flood 356 acres; a small reservoir, 39 acres. (4)

In addition, a preliminary review indicates that two 100 K. V. transmission lines at the upper end of the proposed reservoir would have to be relocated. The land required would be removed from other uses.

Alternative 4 - Denial of a permit would require the developer to consider maintaining the status quo or using other means to provide water for the proposed irrigation and residential development. Other means of supplying water could include the development of ground water, the transfer of use under other decreed rights to this project, the purchase of decreed water, or a combination of these methods. If existing water rights were transferred or other decreed rights purchased, then a land use change could occur on those other lands currently irrigated with this water, and they may revert back to non-irrigated use.

Secondary Impacts - Land use intensifies with the beginning of residential activity, and environmental changes inevitable occur. Such changes are discussed in greater detail in other sections of this Environmental Impact Statement.

Terrestrial and Aquatic Life

Effects of Diversion - Trout populations in Prickly Pear Creek depend on the existing flow regime. While extreme high flows may adversely affect trout habitat, extreme low flows are, in general, the limiting factor that controls or reduces populations. Low flows impact fisheries through the desication of riffle areas and the reduction of security

areas.

Riffle areas, generally covered by a shallow sheet of rapidly-flowing water, are the food-producing areas of trout streams. In these areas aquatic invertebrates with limited mobility live in spaces between the stream-bed gravels, depending upon the flowing water for a supply of food and oxygen. Oxygenated water is also supplied to incubating fish eggs deposited in the same areas. Dewatering streams below a critical level exposes these areas and dries them. As a result, food production is eliminated, and deposited eggs suffocate.

In trout streams of the general size of Prickly Pear Creek, fish require security areas normally provided by undercut banks and overhanging streamside vegetation. Without this security, trout populations are severely reduced. (2))Flow reduction below a critical level dewateres these areas long before total dewatering of the stream is apparent, severely reducing the streams security and, consequently, its carrying capacity for adult trout.

In evaluating Prickly Pear Creek, the Montana Department of Fish and Game determined that, to maintain the integrity of trout fishing in Prickly Pear Creek above East Helena, water could be diverted only to a level that maintains 17 c.f.s. in the stream during fall, winter, and summer. In extreme low flow situations a 14 c.f.s. flow would be acceptable for short time periods. During the spring, much higher discharges are necessary to maintain the natural flow regimes.

As shown in Table 14, granting a permit for 20 c.f.s. (Alternative 1) will adversely impact fisheries during all months of the proposed time of diversion except April in an average year. Alternative 2 (10 c.f.s.) would have an adverse effect in September, December, January, and February. A diversion of 5 c.f.s. (Alternative 3) cannot be accomplished in the month of January without adversely impacting the fisheries resource.

TABLE 14 - DIVERSION CONSTRAINTS

Maximum Allowable Water Diversion Rate as Constrained
by Existing Rights or Fisheries, Whichever is Greater

Month	Average Flow at Point of Diversion (c.f.s.)	Minimum Existing Rights* (c.f.s.)	Fisheries Requirement (c.f.s.)	Remaining Flow **** (c.f.s.)
Sept.	29.0	19.3**	17.0	9.7
Oct.	31.6	19.3**	17.0	12.3
Nov.	29.9	14.3	17.0	12.9
Dec.	24.1	14.3	17.0	7.1
Jan.	21.1	14.3	17.0	4.1
Feb.	24.0	14.3	17.0	7.0
Mar.	31.9	19.3**	17.0***	12.6
April	52.6	19.3**	17.0***	33.3

* Does not include stockwater rights that may exist

** Reflects an estimated late or early irrigation demand of 5 c.f.s.

*** A flow greater than 17 c.f.s. is necessary to maintain fisheries in the spring.

**** Livestock watering requires an undetermined amount of water in the stream to prevent complete freezing during winter months.

Source: Montana Department of Natural Resources and Conservation and Montana Department of Fish and Game, 1974.

A flow rate below 14 c.f.s. for long periods of time may also adversely affect the beaver, muskrat and waterfowl populations using this stream.

Denial of the permit, Alternative 4, would have an unknown impact on terrestrial and aquatic life.

Effects of Suburban Development - As development increases, so does the loss of wildlife habitat. In addition, greater numbers of people would presumably result in intensified fishing and recreational pressures throughout the general area. Most wildlife would disappear or become

relatively more scarce under such conditions.

Aesthetics, Natural Beauty and Tranquility

Decreased flows under Alternative 1 through 3 may adversely affect the aesthetics, natural beauty and tranquility of the entire stream. Suburban development would reduce such values throughout the development area.

Recreational Opportunities and Quality

Overall recreational opportunities and quality, which are highly dependent on fishing, would decrease with a decline in the trout population in Prickly Pear Creek to be expected under Alternatives 1 through 3. The amount of water in the creek would have less effect on other recreational opportunities, but might reduce their quality.

Planning and implementation could save and further develop certain of the recreational values, such as bicycling, and make them available to more people. Open space remaining within the development area could be protected and managed.

VI. ECONOMIC AND SOCIAL IMPACTS

The impact area to be considered in Section VI includes the contiguous land holdings of the applicant at the reservoir site, lands proposed for irrigation below the proposed point of diversion, riparian lands and water users on Prickly Pear Creek, and the rest of Lewis and Clark and Jefferson Counties. To enhance the usefulness of this Section, assumptions are clearly spelled out.

Alternative 1

If Diehl Development Corporation is granted 20 c.f.s. from September 16 to April 14, it is assumed that the applicant would build a 210 foot high, earth-filled dam in Clark Gulch, a 60 foot dam in Holmes Gulch, and a pumping station and buried pipe delivery system. However, because data concerning the Holmes Gulch dam is not available, those figures are not considered in the following analysis.

Primary construction employment and income would be 133 man-years and \$2 million, respectively. Total employment and income (including derivative) would be 412 man-years and \$5,380,000.

Given known stream flow information, it is estimated that 4,973 acre feet (A.F.) could be diverted from the stream each year under Alternative 1. Evaporation losses, assuming a full reservoir, would reduce that to about 4,006 A.F. No seepage estimate is made.

Assuming 3 A.F./acre irrigation depletion, approximately 1,335 acres could be irrigated. Raising hay at 4.5 tons per acre, the total annual production would be 6,007 tons at \$70 per ton, and the annual crop value would be \$420,490.

Data generated by the Department for preparation of the State Water Plan indicate average domestic water consumption in the Missouri Basin

portion of Montana is 226 gallons per capita day (GPCD). Conversion of all 4,006 A.F. of stored water to domestic use for the subdivision, using 226 GPCD (or .253 A.F./yr.), means that the total water needs of 15,834 people could be satisfied.(12)

Assuming 3.1 persons per residence, this would come to 5,107 new residences. In 1970, there were 246,603 housing units in Montana. (13) Consequently, the number of new residences which could be supported by water stored for the Diehl Development Corporation S. E. Helena Project is equivalent to 2 percent of all housing units in Montana, or 37 percent of the 13,925 housing units existing in Jefferson and Lewis and Clark Counties, in 1970. (13)

Alternative 2

If Diehl Development Corporation is granted 10 c.f.s. from September 16 to April 14, it is assumed that the applicant would build a 170 foot high, earth-filled dam in Clark Gulch, a 60 foot dam in Holmes Gulch, and a pumping station and buried pipe delivery system. Again, because data concerning the Holmes Gulch dam is not available, those figures are not considered in the following analysis.

Primary construction employment and income would be 69 man-years and \$1 million, respectively. Total employment and income (including derivative) would be 214 man-years and \$2,690,000.

It is estimated, using monthly averages of available water, that 3,989 A.F. could be delivered to the Clark Gulch reservoir in a normal year and that an estimated 3,340 A.F. would be available after subtracting evaporation losses from a full reservoir.

This amount would irrigate 1,113 acres and produce 5,009 tons of hay with an annual value of \$350,630.

Conversion of this water for domestic use by a subdivision development

means water for 13,201 people in 4,258 residences. That number of residences is equivalent to 31 percent of those in Lewis and Clark and Jefferson Counties in 1970.(13)

Alternative 3

If Diehl Development Corporation is granted 5 c.f.s. from September 16 to April 14, it is assumed that the applicant would build a 150 foot high, earth-filled dam in Clark Gulch, a 60 foot dam in Holmes Gulch, and a pumping station and buried pipe delivery system. Again, because data concerning the Holmes Gulch dam is not available, those figures are not considered in the following analysis.

Primary construction employment and income would be 50 man-years and \$750,000, respectively. Total employment and income (including derivative) would be 155 man-years and \$2,017,500.

Estimated diversion water available on an average annual basis is 2,111 A.F. Evaporation would reduce this amount to 1,610 A.F., assuming a full reservoir.

This amount would irrigate 537 acres, producing 2,416 tons of hay worth \$169,120 each year.

Conversion of this water for use by a subdivision development would provide for 6,363 people in 2,053 residences, or 15 percent of the housing units in both Lewis and Clark and Jefferson Counties in 1970. (13)

Alternative 4

Impacts resulting from denial of a permit are difficult to assess. The applicant owns extensive lands suitable for subdivision. He also owns and is attempting to purchase additional decreed water rights on the stream. Therefore, it is reasonable to assume that, in the absence of a permit for additional water, he will still proceed to subdivide the land, but, probably at a reduced density and rate.

Housing Demand

In the absence of any information from the applicant on future housing demand in the two-county area, population and housing data have been collected and analyzed. Historical population data have been projected as a linear function of time to 1985. The very regular growth of the area (closely related to its dependence on government as the economic base) suggests that such a projection is meaningful.

TABLE 15 - POPULATION, HISTORICAL AND PROJECTED

Lewis and Clark and Jefferson Counties

	1950	1960	1970	1980	1985
Lewis and Clark	24,540	28,006	33,281	37,350	39,535
Jefferson	4,014	4,297	5,238	5,740	6,046
TOTAL	28,554	32,303	38,519	43,090	45,581

Source: Montana Data Book, 1970, and Montana Department of Natural Resources and Conservation, 1974.

It is interesting to note that the total projected increase in both Counties from 1970 to 1985 is 7,062 persons. This compares with supportable populations of 15,834 (Alternative 1), 13,201 (Alternative 2), and 6,363 (Alternative 3) in the subdivision development.

The 1970 census counted 12,359 housing units in Lewis and Clark County and 1,566 in Jefferson County, making a total of 13,925. Housing units which could be provided water under Alternatives 1, 2, and 3 are,

respectively, 37 percent, 31 percent, and 15 percent of the 1970 two-County total.

Dams and Reservoirs

As noted earlier, a major element of the proposed action is the construction of two storage reservoirs, but the sizes of the dams and attendant impoundments have not been finalized at this time. In that exact plans are not available, an assesment of impacts associated with these facilities is somewhat speculative.

The reservoirs would improve the applicant's ability to irrigate certain portions of his land. Additionally, they would provide a domestic water supply for the intended suburban development. Depending upon the nature of drawdowns, they may provide certain recreational benefits.

However, their construction will require the commitment of land to a single use. In addition, to a certain extent their presence will hasten urbanization with its concomitant impacts as noted elsewhere in this statement.

A further consideration concerns the safety of the dam structures and potential downstream impacts. Because the dams will be located on tributaries of Prickly Pear Creek, upstream from the City of East Helena, ample justification exists for especially safe structures. Therefore, the design and construction of the structures should be based upon criteria established by the various federal agencies for dams with a high hazard classification. There must be careful consideration of such factors as danger to downstream populations, damage to the drainage area, and costly property damage which would be incidental to the failure of a dam. Further, the design of the structures should reflect thorough consideration of the known geologic faults in the area. Detailed onsite studies will be needed as a means to assure their safety and effectiveness.

Cost of Water

Since the applicant's initial use of the water is for irrigation, it is meaningful to estimate the cost of water. Table 16 summarizes the costs under the three alternatives, considering construction and operation of a diversion, pumping, and Clark Gulch storage system. The figures do not include the costs of construction, operation and maintenance of the 60 foot high dam in Holmes Gulch or any costs of delivering water from the reservoir to crop lands. Therefore, the average annual costs per acre foot and per irrigated acre must be considered low estimates.

TABLE 16 - COST SUMMARY

	ALTERNATIVE 1 20 c.f.s.	ALTERNATIVE 2 10 c.f.s.	ALTERNATIVE 3 5 c.f.s.
Construction			
Clark Gulch Dam	\$5,400,000	\$2,700,000	\$1,900,000
Pumping System	<u>470,000</u>	<u>450,000</u>	<u>430,000</u>
Total Construction	\$5,870,000	\$3,150,000	\$2,330,000
Annual			
Construction (30 years at 8%)	\$ 521,414	\$ 279,805	\$ 206,967
Pumping (Power)	36,328	29,542	15,651
O & M (1% of Construction)	<u>58,700</u>	<u>31,500</u>	<u>23,300</u>
Total Annual	\$ 616,442	\$ 340,847	\$ 245,918
Average Annual Water Available (A.F.)	4,006	3,340	1,610
Average Annual Acres Irrigated	1,335	1,113	537
Average Annual Cost Per Acre Foot	\$ 153.88	\$ 102.05	\$ 152.74

Source: Montana Department of Natural Resources and Conservation, 1974.

Pumping Requirements

The energy requirements of and operating expenses for the pumping facility are presented by alternative on Table 17. The derived operating expense values were used in estimating the average annual cost associated with irrigation use of the diverted water.

TABLE 17 - PUMPING FACILITY

Estimated Energy Requirements and Operating Expense

Month	Pumping Rate (c.f.s.) By Alternative			Hours of Operation*	Energy Demand By Alternative (KWH)		
	1	2	3		1	2	3
Sept.	9.7	9.7	5.0	384	275,911	275,911	142,222
Oct.	12.3	10.0	5.0	744	677,867	551,111	275,556
Nov.	15.6	10.0	5.0	720	832,000	533,333	266,667
Dec.	9.8	9.8	5.0	744	540,089	540,089	275,556
Jan.	6.8	6.8	5.0	744	374,756	374,756	275,556
Feb.	9.7	9.7	5.0	672	482,844	482,844	248,889
Mar.	12.6	10.0	5.0	744	684,400	551,111	275,556
Apr.	20.0	10.0	5.0	336	497,778	248,889	124,444
Total Energy Demand (KWH):					4,375,645	3,558,044	1,884,446
Total Operating Expense:**					\$36,328	\$29,542	\$15,651

* Assumes 24 hours of operation per day

** Based upon electrical rates for agricultural use

Source: Montana Department of Natural Resources and Conservation, 1974.

Overview

Possible actions by the applicant can indeed have a significant economic effect in the impact area. There, is, however, considerable uncertainty regarding the specific nature and timing of the applicant's development plans.

Table 18 summarizes the economic information which has been developed in this assessment. The implications of denying the permit (Alternative 4) were not analyzed.

TABLE 18 - ECONOMIC SUMMARY

	Alternative		
	1	2	3
Subdivision Population (Ultimate Max.)			
Persons	15,834	13,201	6,363
Households	5,107	4,258	2,053
Local Construction Impact			
Employment-Primary (Man-years)	133	69	50
Secondary (Man-years)	279	145	105
Income-Primary (\$)	2,000,000	1,000,000	750,000
Secondary (\$)	3,380,000	1,690,000	1,267,500
Construction Cost (\$)	5,870,000	3,150,000	2,330,000
Irrigation (Acres)	1,335	1,113	537
Annual Production (Tons of Hay)	6,007	5,009	2,416
Annual Value of Production (\$)	420,490	350,630	169,120

Source: Montana Department of Natural Resources and Conservation, 1974.

Other economic impacts have not yet been discussed, including the substantial effects on tax revenues. The impact of Alternative 1 on Jefferson County would be tremendous. The number of residences in the County could be quadrupled, and real property tax revenues from houses would probably grow at least in that magnitude. Some of the water would serve as stock water for 250 head of cattle. However, this cannot be construed as a significant economic contribution,

The development of a large subdivision would have significant impacts in the form of many services which the residents would require. These would include transportation arterials, schools, retail facilities, solid and sanitary waste disposal, gas, electricity, etc.

Because no social or cultural system really exists on the land today, no great loss is expected. There could, however, be significant social, cultural, and recreational losses downstream. The response to this Environmental Impact Statement will be an index of personal perceptions of such impacts.

VII. RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENTAL AND LONGTERM PRODUCTIVITY

Agricultural productivity will increase if the Prickly Pear water diversion is permitted and irrigation of land begins. Small grain, hay, and forage crops could be productively produced with irrigation.

However, diverted and consumed streamflow is no longer available for maintaining aquatic communities in Prickly Pear Creek. Therefore, depending on the rate of withdrawal, productivity of these communities may decrease. Aquatic ecosystems involve intricate interrelations between groups of living organisms and their water environment. Fish exist at the top of the aquatic food chain and are dependent upon the many small organisms comprising lower trophic levels. In turn, these smaller organisms are dependent upon a complicated interplay of nutrient cycles. If qualitative or quantitative changes in any one factor exceed an organism's limit of tolerance, the vigor of the organism will be reduced, and it may ultimately be eliminated from the system. Therefore, to assure a thriving population of fish, it is necessary to maintain a productive habitat for both the fish and plants and animals upon which fish are dependent.

One important condition affecting stream communities is current or flow velocities, which govern differences in channel characteristics. At times, varying discharges scour a stream bottom; at others, they provide for the deposition of quantities of silt. As a result of varying currents, streams include pools, runs, riffles and various shore and bottom variations. Fish are dependent upon these variations in stream for production and security. Small organisms, upon which fish depend for food, have adapted to and require these conditions.

Another characteristic of streamflow is the transport of dissolved substances, suspended materials, and living plants and animals. (16)

Aquatic communities depend upon a flow of water to supply food and

oxygen.

Water temperature is another important environmental factor, because aquatic organisms often have narrow temperature tolerances. (14) A reduction in Prickly Pear stream flow may increase the temperature of remaining water. Depending upon the amount of increase, certain long-term changes in the salmonid fisheries can be expected.

When a quantity of streamflow is diverted and consumed for other uses, certain physical and biological alterations occur, depending upon the amount diverted. Therefore, a tradeoff exists between those necessary conditions provided living organisms by an adequate quantity of flowing waters and the amount of water diverted from the stream. Streamflow can be diverted for other uses with minimal biological effects only if a sufficient flow remains. If water is withdrawn below this critical level, biological tradeoffs become increasingly greater.

Prickly Pear Creek above East Helena currently supports a viable trout population. It has been determined that, to maintain this population, a streamflow of at least 17 c.f.s. is needed, and that much higher flows are needed in the spring. For short periods, of less than 30 days, a streamflow of 14 c.f.s. could be endured. If a quantity of water were diverted to reduce the flow below these threshold levels or substantially reduce the naturally-occurring high flows during the spring, then a significant commitment of productive aquatic habitat will be made.

Also, if flows below these levels are permitted, certain physical changes in the stream would adversely affect those wildlife species requiring an aquatic habitat such as beaver, muskrat, and waterfowl.

As the proposed development area becomes occupied by people, additional environmental changes will occur. Land supporting irrigated cultivation, livestock grazing, and wildlife range will be transformed into suburbs.

This land use change will reduce agricultural productivity and will bring about a decline in the variety and number of wildlife species within the developed area.

However, the development of this area for urban uses would tend to concentrate building adjacent to an already urbanized area. Therefore, more productive cropland elsewhere might be saved from urbanization.

VIII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Initial Commitments

Granting a beneficial water use permit means that certain resources will be committed in the diversion, transportation and storage of water.

The diversion and consumption of Prickly Pear Creek water is, in essence, an irretrievable commitment of a finite natural resource. Future water use opportunities are essentially foreclosed for water which is consumed. Montana's prior appropriation doctrine recognizes this commitment in the principle of "first in time, first in right."

The planned water storage reservoirs would flood certain lands, thereby precluding other surface use options.

Pumping water from Prickly Pear Creek to a higher elevation reservoir would require a substantial commitment of electrical power. Depending upon the source of the electrical energy, this demand may require an irreversible commitment of fossil fuels. Additional energy (in the form of fossil fuels) would be consumed during the dam and pipeline construction.

Earth substances like fill material, gravel and rock would be extracted and committed for construction of dams and roads. Metals in the form of motors and water lines would be needed. Other materials including cement, wood products, and petrochemicals would also be committed for use in the structures.

Subsequent Commitments

With the granting of a beneficial use permit, development of the applicant's property could proceed. The initial conversion of grazing land to irrigated cropping would involve those irreversible commitments of resources above described and additional commitments of materials

and energy for the sprinkler system. Later, when suburban facilities are developed to support a possible population of 8,500 people, substantial amounts of raw materials, land and energy would be irreversibly committed to the construction and operation of homes, streets, sewage works, and other urban requirements.

IX. AGENCIES, GROUPS AND INDIVIDUALS FROM WHOM COMMENTS HAVE BEEN
REQUESTED

Federal

Mr. A. B. Linford
State Conservationist
U. S. Soil Conservation Service
P. O. Box 970
Bozeman, MT 59715

Mr. Frank McChesney
Dept. of Intergovernmental Relations
1424 9th Avenue
Helena, MT 59601

Mr. Steve Yurich, Regional Forester
U. S. Forest Service
Federal Building
Missoula, MT 59801

Dr. John Anderson, Director
Dept. of Health & Environmental
Sciences
Cogswell Building
Helena, MT 59601

Mr. Edwin Zaidlicz, State Director
Bureau of Land Management
316 North 26th Street
Billings, MT 59101

Mr. George B. Lackman, Commissioner
Department of Agriculture
Agriculture Building
Helena, MT 59601

State or Local Agencies

Dr. Glenn C. Halver
Department of Livestock
Livestock Building
Helena, MT 59601

Mr. Torlief Aasheim, Chairman
Rural Areas Development Committee
Montana State University
Bozeman, MT 59715

Prof. M. J. Edie
Department of Earth Sciences
Bozeman, MT 59715

Mayor, City of East Helena
East Helena, MT 59635

Mr. Wesley R. Woodgerd, Director
Department of Fish and Game
Sam W. Mitchell Building
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Dean Robert Wambach
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